UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL OCEAN SERVICE

Office or Response and Restoration
Silver Spring, Maryland 20910

CRUISE REPORT[1]

VESSEL: *Hi`ialakai*, Cruise 05-05 (Fig. 1)
CRUISE

PERIOD: 14 July−25 July, 31 July−7 August 2005

AREA OF OPERATION: Main Hawaiian Islands

TYPE OF OPERATION: Personnel from the Coral Reef Ecosystem Division, Pacific Island Fisheries Science Center (PIFSC), National Marine Fisheries Service (NMFS), NOAA, conducted reef assessment/monitoring and mapping studies in waters surrounding the Main Hawaiian Islands.

ITINERARY:

14 July — Start of cruise. Embarked Craig Musburger (fish), Darla White (fish), Jeff Eble (fish), Greta Aeby (coral), Jean Kenyon (coral), Scott Godwin (invertebrates), Ranya Henson (invertebrates), Peter Vroom (algae), Emily Krause (algae), Joe Laughlin (towboard/fish), Benjamin Richards (towboard/fish), Jamison Gove (towboard/habitat), Casey Wilkinson (towboard/habitat), Amy Hall (moorings), Kyle Hogrefe (moorings), Ronald Hoeke (moorings), Charles Young (moorings), Parker Mason (moorings), John Rooney (QTC/TOAD/CTD), Susanna Holst (QTC/TOAD/CTD), and Haiying Wang (data management). Departed Snug Harbor at 0900. Arrived off Kaena Point, Oahu at 1300 for small boat drills, followed by rapid ecological assessments (REA), towboard, and oceanographic surveys. The fish and benthic REA teams completed assessments at one site south of the point. The towboard team completed one tow directly off the point, and the mooring team finished six conductivity-temperature-depth (CTD casts.

[1] PIFSC *Hi'ialakai* Cruise Report CRHI-05-003
Issued 7 November 2005

Three towed optical assessment device (TOAD) operations were completed around Kaena Point. We departed Oahu en route to the windward side of Kauai at 2330.

5 July — Began work on the northeast side of Kauai. The tow team completed six benthic and fish tows, and the REA team conducted three fish and benthic surveys. The mooring team finished 25 shallow water CTDS, and conducted water sampling profiles at two sites. An STR was deployed at REA site KAU2. Night operations around the northeast side of Kauai included four TOAD drops and one deepwater CTD. A safety meeting was held by night operations personnel before night operations began.

16 July — Continued working around Kauai, focusing on the east/southeast sides. The tow team completed six benthic and fish tows. The first REA dive at KAU4 was in strong current, and no video transects or quantitative algal data were collected. Full REA protocols were conducted at sites KAU5 and KAU6. The mooring team completed 35 CTDs (9 being points on a transect Hanapepe Bay); 8 water sample profiles were also collected along the transect. One subsurface temperature recorder (STR) was deployed at REA site KAU5. Night operations consisted of four TOAD deployments around Kauai, followed by an ADCP line with three accompanying deepwater CTDs across the narrowest part of the channel between Kauai and Niihau.

17 July — Began work on the east side of Niihau. The tow team completed six benthic and fish tows, and the REA team conducted three fish and benthic surveys. The mooring team finished 25 shallow water CTDS, and conducted a water sampling profile at 1 site. An STR was deployed at REA site NII2. Night operations consisted of four TOAD deployments, one deepwater CTD, one water sample profile, and multibeam operations around the northwest corner of Niihau.

18 July — Worked around Lehua Rock on the northern tip of Niihau. The tow team completed five benthic and fish tows, and the REA team conducted three fish and benthic surveys. The mooring team finished eight shallow water CTDS, and conducted a water sampling profile at one site. The STR deployed on 7/17 at NII2 was relocated to NII1 on the northeast side of the island, and one additional STR was deployed. Night operations consisted of three TOAD deployments, one deep water CTD, one water sample profile, and multibeam operations around the northwest side of Niihau.

19 July — Worked on the west side of Niihau. The tow team completed five benthic and fish tows, and the REA team conducted three fish and benthic surveys. The mooring team finished nine shallow water CTDS and conducted a water sampling profile at one site using the new 4-bottle sampler. Night operations consisted of five TOAD surveys. Transited to Kauai.

20 July	Worked on the northwest side of Kauai (Na Pali coast). The tow team completed five benthic and fish tows, and the REA team conducted three fish and benthic surveys. The mooring team finished 25 shallow water CTDS, conducted 6 water sampling profiles in a linear series in Hanalei Bay, and scouted out a site for a WTR deployment. Night operations consisted of five TOAD surveys and some "sloppy" multibeam surveys.
21 July	Worked on the southwest side of Kauai. The tow team completed six benthic and fish tows, and the REA team conducted three fish and benthic surveys. The mooring team finished 18 shallow water CTDS, conducted 5 water sampling profiles in a linear transect in Waimea Bay, and deployed a WTR on Mana reef. While on Mana reef, the mooring team also spent ~30 minutes searching for species of the scleractinian coral *Acropora*, but were unable to locate any colonies (although coral cover of other genera was fairly high). One short TOAD camera survey was conducted around the southwest shore of Kauai before we departed for Oahu.
22 July	Worked around Kaena Point on Oahu. The tow team completed six benthic and fish tows, and the REA team conducted three fish and benthic surveys. The mooring team finished 17 shallow water CTDS, conducted 1 water sampling profile, and deployed 4 STRs (3 in a linear array approximately 1 mile from OAH3, and one at site OAH5). Night operations consisted of one TOAD tow (followed by cable problems with the TOAD) and multibeam mapping.
23 July	Worked on the north side of Oahu between Kualoa and Waimea Bay. The tow team completed five benthic and fish tows, and the REA team conducted three fish and benthic surveys. The mooring team finished 31 shallow water CTDS, conducted 6 water sampling profiles on a linear transect in Kahana Bay, and deployed 1 STR off Punaluu. Night operations consisted of multibeam mapping.
24 July	Worked on the north side of Oahu between Turtle Bay and Mokuleia. The tow team completed five benthic and fish tows, and the REA team conducted three fish and benthic surveys. The mooring team finished 12 shallow water CTDS, and conducted 6 water sampling profiles (five of them on a linear transect in Haleiwa Bay).
25 July	Returned to Honolulu because of a medical concern with one of the ship's crew. Disembarked Musburger, White, Eble, Aeby, Kenyon, Godwin, Henson, Vroom, Krause, Laughlin, Richards, Gove, Wilkinson, Hall, Hogrefe, Hoeke, Young, Mason, Rooney, Holst, and Wang.
26-30 July	In port.

31 July	Continuation of cruise. Embarked Craig Musburger (fish), Todd Wass (fish), Jeff Eble (fish), Dan Bashis (coral), Jean Kenyon (coral), Scott Godwin (invertebrates), Ranya Henson (invertebrates), Ryan Okano (algae), Emily Krause (algae), Joe Laughlin (towboard/fish), Benjamin Richards (towboard/fish), Elizabeth Keenan (towboard/habitat), Casey Wilkinson (towboard/habitat), Jamison Gove (moorings), Peter Vroom (moorings), Delisse Ortiz (moorings/night ops), John Rooney (QTC/TOAD/CTD), Jeremy Jones (moorings/night ops), and Haiying Wang (data management). Departed Snug Harbor at 0900 and conducted safety drills. Arrived off west side of Molokai at 1330 and began REA, towboard, and oceanographic surveys. The fish and benthic REA teams completed assessments at one site. The towboard team completed two tows, and the mooring team finished five CTD casts, three water samples taken in a linear transect, and deployed one STR at REA site MOL1. Night operations consisted of multibeam sonar around the south side of the island
1 August	Worked on the southwest side of Molokai. The tow team completed five benthic and fish tows, and the REA team conducted three fish and benthic surveys. The mooring team finished 25 shallow water CTDS, collected 11 water samples (3 transects, 2 4-sample depth profiles and 1 3-sample depth profile), and deployed 1 STR at REA site MOL3. Night ops consisted of a little bit of multibeam work that was hampered by boat traffic, and one deepwater CTD.
2 August	Worked on the west side of Lanai. The tow team completed five benthic and fish tows, and the REA team conducted three fish and benthic surveys. The mooring team finished 20 shallow water CTDS, and conducted 10 water sampling profiles (2 4-sample depth profiles and 1 2-sample depth profile). One deep-water CTD was taken during daylight hours.
3 August	Worked on the east and south side of Lanai. The tow team completed five benthic and fish tows, and the REA team conducted three fish and benthic surveys (minus one invertebrate diver on the last dive of the day). The mooring team finished 20 shallow water CTDS, collected 8 water profiles (2 4-sample depth profiles), and deployed 2 STRs. One deep-water CTD was taken during daylight hours. Night ops consisted of multibeam mapping of the northern part of Lanai.
4 August	Worked on the southwest corner of Maui. The tow team completed five benthic and fish tows, and the REA team conducted three fish and benthic surveys (minus one invertebrate diver on the middle dive of the day). The mooring team completed 28 shallow water CTDS. Night operations consisted of multibeam mapping in Maalaea Bay.

5 August	Worked on the northwest side of Maui around Lahaina. The tow team completed five benthic and fish tows, and the REA team conducted three fish and benthic surveys. The mooring team finished 33 CTDs and deployed 1 STR at site MAI9. Night operations consisted of multibeam mapping in Maalaea Bay.
6 August	Worked around southwest Maui (Kihei area) and Molokini. The tow team completed three benthic and fish tows, and the REA team conducted three fish and benthic surveys. Because of a sick diver, fish REAs were restricted to belt transects. No Stationary Point Count observations were made. The mooring team finished 11 CTD casts and deployed 2 STRs. Night operations consisted of multibeam mapping in Maalaea Bay.

Table 1: Cruise statistics for the Main Hawaiian Islands, summer cruise 2005.

CRUISE STATISTICS:

	Kauai	Niihau/Lehua Rock	Oahu	Molokai	Maui/Molokini	Lanai	**Totals**
Towed Diver Habitat/Fish Surveys	23	16	17	7	13	10	86
Linear kilometers of tow track	53.16	39.69	48.38	18.89	30.95	23.58	214.65
Fish Rapid Ecological Assessments	12	9	10	4	9	6	50
Benthic Rapid Ecological Assessments	12	9	10	4	9	6	50
Shallow water samples	21	3	13	14	0	18	69
Deep water sample profile	0	2	0	2	0	0	4
STR deployed	2	2	5	0	3	2	14
WTR deployed	1	0	0	0	0	0	1
TOAD drop camera surveys	13	12	4	0	0	0	29
ADCP	1	0	0	0	0	0	1
Nautical miles of ADCP track	14	0	0	0	0	0	14
Deep water CTDs	4	2	0	2	0	3	11
Shallow water CTDs	103	42	63	30	72	40	350
SCUBA dives	173	129	143	44	117	81	687

MISSIONS AND RESULTS:

A. Established quantitative methods were used to estimate numerical abundance of fishes and fish species richness. Sites were selected to add spatial coverage to previous monitoring efforts by state and other agencies. Sampling was focused primarily in the 10-15-m depth range in coral reef habitat. See Appendix A for individual island descriptions.

1. A total of 49 new and 1 previously surveyed stations (by DAR) throughout the MHI were surveyed for fishes by the 3-diver fish REA team. The repeated station was on the protected western coast of Lanai. Ocean conditions precluded the surveying of windward sites on many of the islands, so most stations surveyed were on the southern and western facing shores. Fish assemblages were numerically dominated by large numbers of small-bodied planktivores (primarily pomacentrids), small-bodied wrasses (labrids), and medium-bodied herbivores (primarily acanthurids). Predators and highly prized food fish were rare or absent at most sites. Sharks were rarely encountered, and they were not encountered on transects at any station surveyed.

B. Conducted surveys to document the species composition, relative abundance, percent cover, size distribution, and general condition of the shallow water anthozoans at Kauai, Niihau, Lehua, Oahu, Molokai, Lanai, and Molokini (Appendix B).

1. REA surveys were conducted at 50 sites at Kauai (12), Niihau (6), Lehua (3), Oahu (10), Molokai (4), Lanai (6), Maui (6) and Molokini (3). Twenty-seven anthozoan species were enumerated within belt transects; an additional seven anthozoan species were observed outside belt transects. *Porites lobata* is typically the numerically most abundant coral at these islands, with *Pocillopora meandrina*, *Montipora capitata,* or *Montipora patula* the next most abundant taxon. Average percent cover of live coral, as determined by the line-intercept method, varied from 0% at Lehua to 40.9% at Molokini. Size class distributions at Molokai, Maui, and Molokini show a majority of colonies measuring >10 cm maximum diameter, whereas smaller colonies constitute the majority of the population at other islands visited. The majority (65.4%) of coral colonies from all 50 sites combined have a maximum diameter smaller than 10 cm.

2. Six different coral diseases were encountered during leg 1 surveys (Kauai, Niihau, Lehua, Oahu). The most commonly encountered diseases were with *Porites* trematodiasis (frequency of occurrence =60% of the sites) and *Porites* growth anomalies (50% of the sites). Bleached colonies of *Montipora capitata* were frequently found (83.3% of the sites) and may reflect a normal level of summer bleaching for this coral species. Evidence of *Acanthaster planci* (crown-of-thorns starfish) (animal or feeding scars present) was found at 10 of the 30 sites surveyed (33.3%). An outbreak of COTs was reported by the tow-boarding team at one site (OAH-9) and was subsequently surveyed by the REA team. At this site, 45 animals were counted within a 25 x 4 m belt transect (i.e., density = 4.5 COT/m^2), with more than 100 animals noted elsewhere on the reef.

C. Used quantitative photoquadrat sampling method to collect species composition and baseline abundance data of reef algae at eight islands in the Main Hawaiian Island Archipelago to compare with previously collected qualitative samples (Appendix C).

1. A total of 50 sites were visited (10 @ Oahu, 12 @ Kauai, 6 @ Niihau, 3 @ Lehua, 4 @ Molokai, 6 @ Lanai, 6 @ Maui, 3 @ Molokini). Quantitative analyses were successfully completed at 48 of these sites, producing 576 algal photoquadrats with accompanying field-ranked species lists and voucher specimens. Qualitative analyses

occurred at two sites. At least 29 species of green, 47species of red, and 10 species of brown macroalgae were observed at the eight islands.

D. The non-coral marine invertebrate fauna of coral reefs represents a group of animals that are numerically dominant in their habitat and, in some cases, represent taxonomic groups that are only represented in the marine environment. This group of organisms is surveyed and monitored for the purpose of identifying changes to reef communities. This is accomplished through procedures that quantify a set of target organisms and which also gradually builds an inventory of species to document biodiversity. Macroinvertebrate surveys were conducted to record species composition and abundance at eight islands and atolls in the Main Hawaiian Islands in order to establish baseline data to monitor non-coral invertebrate fauna of each reef system (Appendix D).

1. A total of 50 sites were visited between Maui and Niihau. Species data is preliminary at this point and involves non-coral species quantified from field observations, which represented nine phyla. Despite the surveys being conducted in multiple habitats *Echinostrephus* was the dominant macroinvertebrate found at all islands.

E. Used benthic and fish towed-diver survey methods at NWHI to provide a general description of reef habitat, invertebrates, and reef fishes over a large spatial scale. The methods provided assessments and the foundation for monitoring large-scale disturbances and general distribution and abundance patterns of macroinvertebrates and reef fishes over 50 cm total length (Appendix E).

1. A total of 86 towed-diver surveys were conducted totaling approximately 206.3 km of habitat.

Fish Observations:
The Redlip parrotfish (*Scarus rubroviolaceus)* was the most commonly observed fish larger than 50 cm Total Length (TL) at all islands/reefs. Surveys were conducted along multiple habitats yielding relatively low numbers of fishes over 50 cm TL, yet for most islands surveyed *S. rubroviolaceus* was the most commonly observed large fish regardless of habitat. Preliminary quantitative results yielded low shark densities at all reef/island locations during the survey period. Most notable observations included a dead 8-ft Sandbar shark (*Carcharhinus plumbeus*) stuck in a piece of derelict fishing gear off west shore Kauai, a large aggregation of giant trevally (*Caranx Ignobilis*) in a cave off east side Oahu, and a very large (10 ft) galapagos shark (*Carcharhinus galapagensis*) off the south side of Lehua Rock.

Benthic Observations:
Large areas of sand and macroalgae were the dominant habitat. *Pocillopora* and *Porites sp*. dominated the coral communities. A total of 80 crown-of-thorns starfish (COTS), *Acanthaster planci*, were recorded during this cruise. However, in addition to these sightings, a large concentration of over 1000 COTS were detected in one small area off the north shore of Oahu.

F. The Main Hawaiian Islands Reef Assessment and Monitoring Program (MHIRAMP) cruise, HI0505, presented an opportunity for the Coral Reef Ecosystem Division (CRED) to study the general nearshore oceanographic structure around Ni´ihau, Kauai, Oahu, Lanai, Maui, Molokai, and Molokini. Knowledge of oceanographic processes at these islands is fundamental in understanding the structure and function of coral reef ecosystem dynamics such as reef morphology, larvae distribution, productivity, species richness and diversity, growth rates, and overall ecosystem health. Variability in the local hydrographic conditions directly affects water properties such as temperature, salinity, water clarity, and nutrient availability, all of which heavily influence local biological conditions on a reef ecosystem. In order to assess the oceanographic environment of the Hawaiian Islands, CRED employed a variety of data collection methods during the MHIRAMP cruise including Acoustic Doppler Current Profiler (ADCP) data, which provides detailed ocean current structure with depth, was collected around and in between each island. Conductivity, temperature and depth (CTD) casts with an attached Transmissometer (for water clarity) were conducted, and at select locations, concurrent water samples were collected for chlorophyll-a concentrations in nearshore environs. CTD casts, in concert with water samples, provided both a vertical and horizontal spatial picture of water characteristics at each island. In addition, subsurface oceanographic instrumentation was incorporated and included numerous temperature sensors and one wave and tide recorder. Although these instruments will not be retrieved for 2 years, they will eventually provide a continuous time series of data that will help improve our understanding of the various physical oceanographic stresses coral reef ecosystems are exposed to in the main Hawaiian Islands (Appendix F).

G. Night operations during HI0505 included physical oceanographic measurements and benthic habitat mapping activities. The former included shallow (about 100 m maximum depth) and deep (about 500 m maximum depth) CTD casts and water sampling for nutrient analysis. ADCP data were collected during the entire cruise. A total of 21 CTD casts were conducted during the cruise, with 6 of those being deepwater casts. Deep casts were also accompanied by water sampling using Niskin bottles at depths between 3 m and 150 m to better characterize the mixed layer (Appendix G).

Shallow water CTD casts also supported multibeam mapping operations. A total of 246 square kilometers of shallow water seafloor were acoustically mapped around portions of all the main Hawaiian Islands except Hawaii. The TOAD underwater camera sled was deployed a total of 29 times on the cruise, off the islands of Ni'ihau, Kauai, and Oahu. Two tows from the island of Ni'ihau identified the coral genus Acropora at a depth of 64 m. This is a new record for this genus at Ni'ihau.

H. A report from our Dive Master is included in Appendix H.

SCIENTIFIC PERSONNEL:

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Joseph Laughlin, Towboard Team – Fish, JIMAR-UH, PIFSC-CRED
Casey Wilkinson, Towboard Team – Habitat, JIMAR-UH, PIFSC-CRED
Elizabeth Keenan, Team – Habitat, JIMAR-UH, PIFSC-CRED
Kyle Hogrefe, Mooring Team, JIMAR-UH, PIFSC-CRED
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DATA COLLECTED:

Fish species lists for each site based on roving diver surveys including (a) in situ observations recorded by the diver, and (b) videotapes recorded from the fish towboard
Quantitative surveys of all reef fishes from belt-transects
Quantitative surveys of all reef fishes over 20 cm TL from stationary point-counts
Percent cover of benthic substrate using in-situ line-intercept method
Videotapes at each site showing general nature of each site (360 degree views) and substrate along 2,
25-m transect lines
Digital images at each site showing site overviews, selected coral species, and coral condition

Coral population parameters at each site including number and size class of coral colonies, by species; relative abundance (DACOR); transect depth; maximum depth; water temperature
Samples of *Pocillopora meandrina* for genetic analyses of species connectivity throughout Hawaiian Archipelago
GPS coordinates of all REA sites and plotted locations; common place names of nearby shoreline area
REA site metadata
Digital images of diseased coral
Field notes on signs of coral bleaching or disease
Samples of diseased coral for histopathological analysis
Digital images from algal photoquadrats
Algal voucher specimens
Algal field notes of species diversity and relative abundance
Digital images of the benthic habitat from towboard surveys
Macroinvertebrate counts from towboard surveys
Quantitative surveys of reef fishes (larger than 50 cm TL) to species level from towboards
GPS tracks from towed-diver surveys
Benthic composition estimations from towboard surveys
SBE39 (Seabird Electronics) depth/temperature data from each of fish and benthic towboard
Videos of the seafloor from TOAD operations
QTC (benthic acoustic signature) data
Acoustic doppler current profiler (ADCP) transects
Conductivity, temperature and depth (CTD) profiles to 500 m
Conductivity, temperature and depth (CTD) profiles with attached transmissometer (for water clarity) to 30 m
Water samples for chlorophyll measurements

(/s/Peter S. Vroom)

Submitted by: _____
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(/s/David Kennedy)

Approved by: _____
David Kennedy
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Attachments

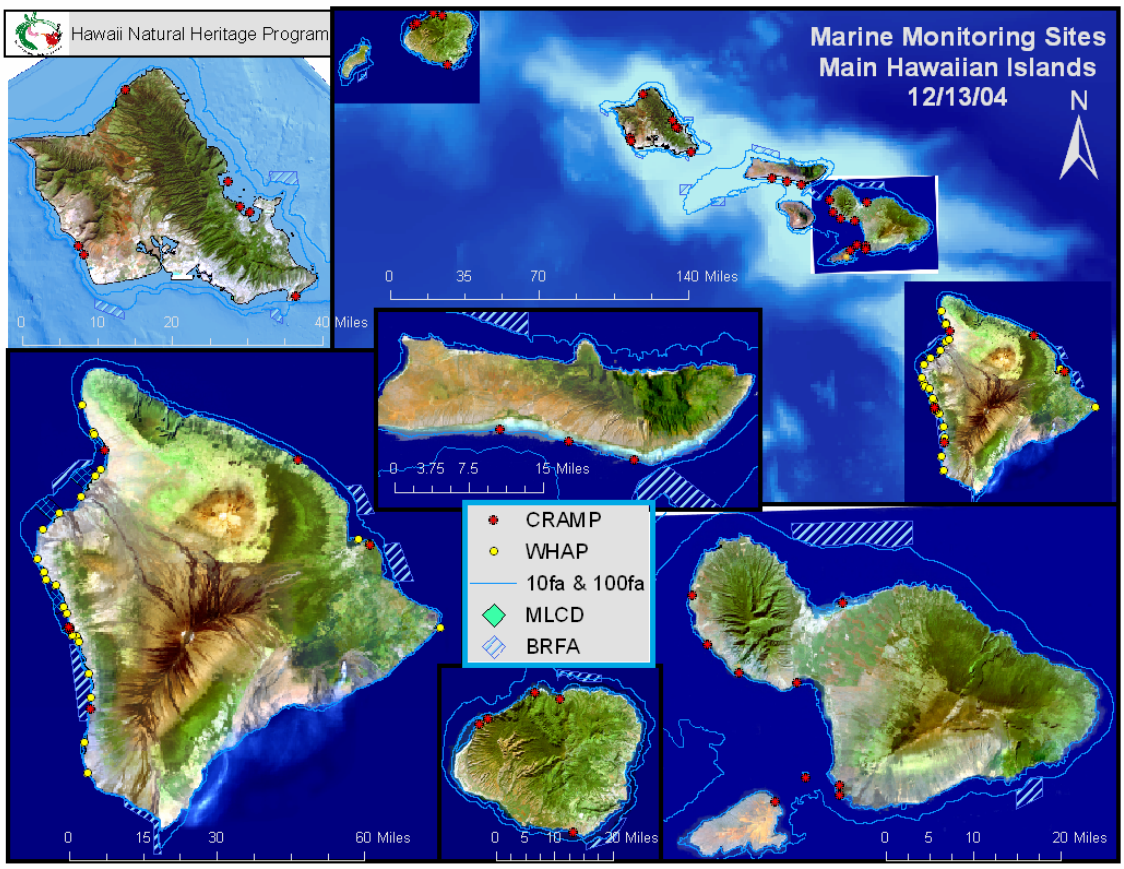

Fig.1. Maps of existing survey sites in the Main Hawaiian Islands. Proposed surveys for HI-05-05 will be the islands of Oahu, Kauai, Niihau, Molokai, Lanai, Maui, and possibly Kahoolawe.